

NAME

- 1 Fernando chooses three different whole numbers between 1 and 40.
The first number is a square number.
The second number is 4 multiplied by the first number.
The third number is a prime number and is less than the first number.
The sum of the numbers is 50.
Find the three numbers.

(3 marks)

- 2 Given that
 $S = 2^3 \times 3^2 \times 7^3$ and $T = 2^4 \times 3^3 \times 7^2$
write down, as a product of its prime factors:

a S^2

(1 mark)

- b the highest common factor (HCF) of S and T

(1 mark)

- c the lowest common multiple (LCM) of S and T .

(1 mark)




3 Here are some properties of a number:

- It is a common factor of 264 and 504.
- It is a common multiple of 4 and 6.
- It is between 20 and 100.

What is the number?

(4 marks)




4 a Write $2(3x + 5) + 4(2x - 1) + 4$ in the form $a(bx + c)$ where a , b and c are integers and $a > 1$.

(3 marks)

b Is $2(3x + 5) + 4(2x - 1) + 4$ divisible by an even number? Explain your answer.

(2 marks)

- 
- 5 Adam, Craig and Gary play hockey.
Adam has scored twice as many goals as Craig.
Gary scores 7 more goals than Craig.
Altogether they score 51 goals.
How many more goals did Adam score than Gary?

(5 marks)

- 6 The n th term of an arithmetic progression is $4n - 3$ where n is a positive integer.
- a Determine whether 84 is a term in the arithmetic progression.

(2 marks)

- b Find an expression for the sum of the n th term and the $(n + 1)$ th term of this sequence.
Give your answer in its simplest form.

(2 marks)

- c The sum of two consecutive numbers in the sequence is 70.
Find the largest of these two terms.

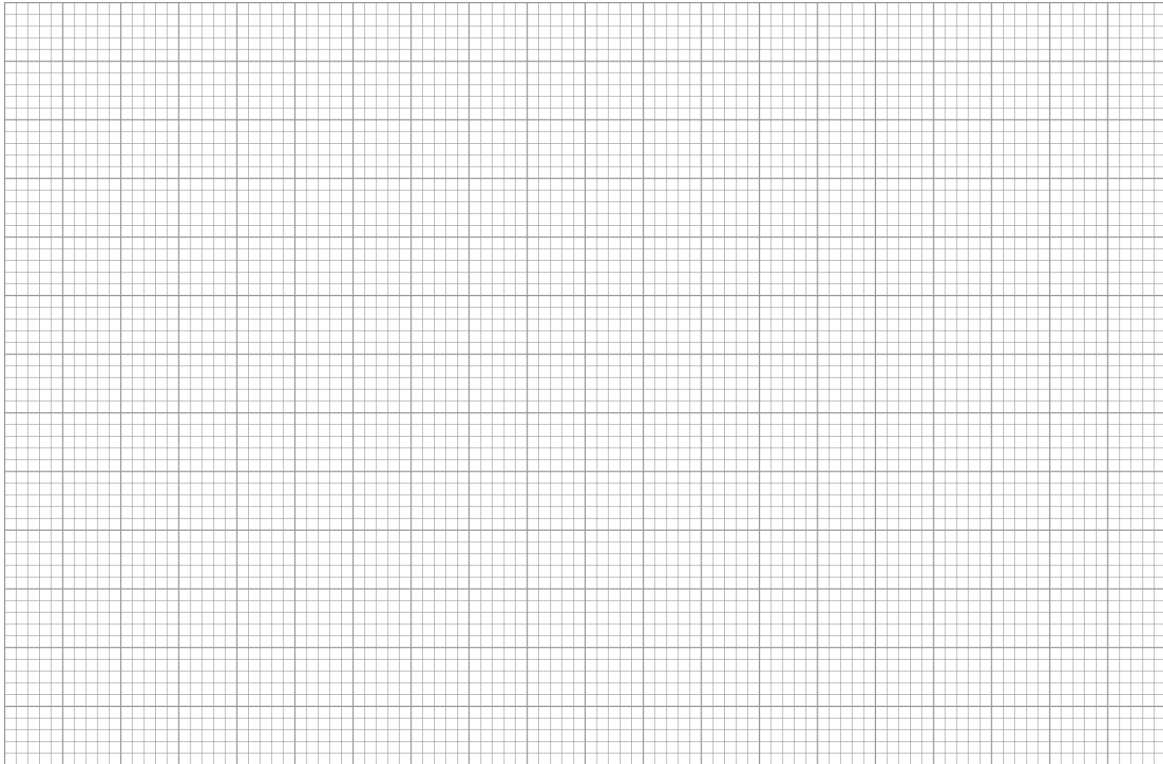
(2 marks)



7 The table shows the population of England (in millions) from 2002 to 2014.

2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
49.6	49.9	50.1	50.5	50.8	51.1	51.5	51.8	52.2	52.7	53.1	53.6	54.0

a Use this information to draw a graph and predict the population in England in 2020.



(4 marks)

b Make two comments explaining why your prediction in part a might not be reliable.

(1)

(2)

(1 mark)



- 8 Jaden wants to invest his savings.

Here are the interest rates offered by two banks:

<p>Bank A</p> <p>Interest:</p> <p>6% for the first year.</p> <p>5.5% for the second year.</p> <p>3% for the third, fourth and fifth year.</p> <p>All interest earned is reinvested.</p> <p>Withdrawals allowed at any time.</p>	<p>Bank B</p> <p>Interest:</p> <p>4.5% per year compound interest.</p> <p>No withdrawals until the end of 5 years.</p>
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Jaden has £20000 he wants to invest.

- a Calculate how much would be in each account after 5 years.

Show your working.

(4 marks)

- b Suggest, with a reason, which account Jaden would be likely to choose.

(2 marks)



9 For every £18 Claire earns she spends £12 on living expenses.

$\frac{3}{5}$ of her living expenses are used for rent.

The remainder of her living expenses is spent on household bills.

What percentage of what Claire earns is spent on household bills?

(3 marks)

10 Javid makes a large container of fruit juice by mixing orange juice and mango juice in the ratio 3 : 7


Orange juice costs £6 per 4 litres.

Mango juice costs £5 per 10 litres.

Javid sells his fruit juice in 2-litre bottles for £2 per bottle.

Calculate how much profit he makes for each bottle he sells.

(5 marks)


- 
- 11** Mark and Nathan shared some money in the ratio 6 : 20

Nathan gave 40% of his money to Mark.

Write the ratio of Mark's money to Nathan's money in its simplest form.

(4 marks)



- 
- 12** A plane leaves the airport and travels east for 2.5 hours at a speed of 240 miles per hour.
It then travels south for 500 miles.

a Calculate the distance of the plane from the airport.

(2 marks)

b Calculate the bearing of the plane from the airport.

(2 marks)

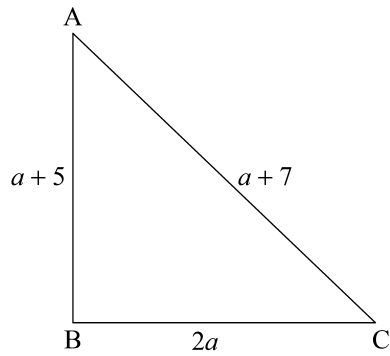


13 Here is a right-angled triangle ABC.

AB is $(a + 5)$ cm

BC is $(2a)$ cm

AC is $(a + 7)$ cm



Calculate the value of the perimeter of the triangle. Give your answer as a whole number in cm.

.....cm

(5 marks)



14 A kite is 30m from the ground. A cyclist observes it flying when he looks up at an angle of 20° .

After 15 seconds, the cyclist has to look up at an angle of 60° to see the kite.

Calculate the speed of the cyclist. Give your answer in km/h.

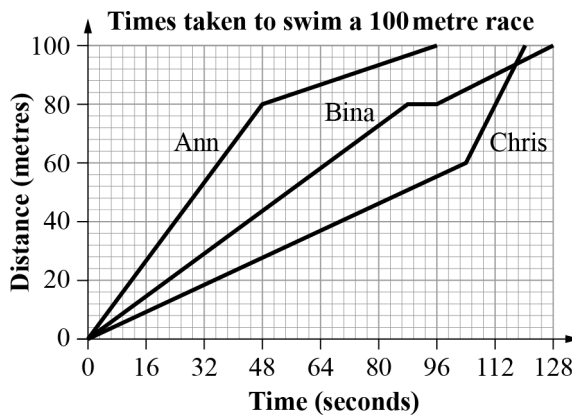
.....km/h

(6 marks)

- 15 Write an expression for the gradient of the line **perpendicular** to the line segment joining $(3p, 6)$ to $(-2p, 10)$.

(2 marks)

- 16 Ann, Bina and Chris swim a 100metre race.
The distance-time graph shows the race.



- a Who won the race? Give a reason for your answer.

(1 mark)

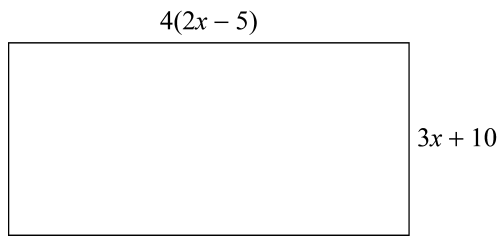
- b One of the swimmers got cramp part way through the race and had to pause.
Which swimmer was this? Give a reason for your answer.

(1 mark)

- c Describe the race.

(4 marks)

- 17 The length of this rectangle is greater than its height.

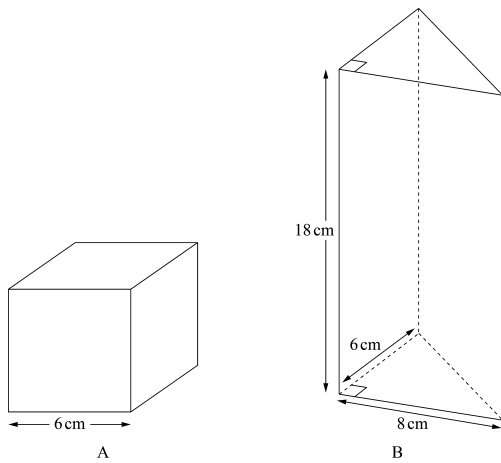


Complete the inequality.

$x > \dots\dots\dots$

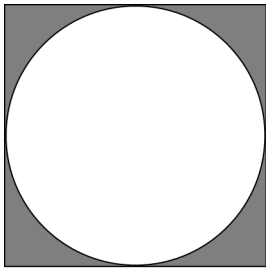
(3 marks)

- 18 The diagram shows a cube A and a right-angled triangular prism B.
Show that the volume of B is 2 times the volume of A.

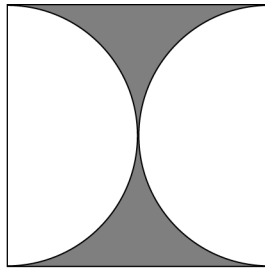


(3 marks)

19 The diagram shows two identical squares.



A



B

Diagram A shows a circle inside a square.

Diagram B shows two identical semi-circles inside a shaded square.

Show that the shaded region in diagram A is equal to the shaded region in diagram B.

(4 marks)

- 20** In the space below, use a ruler and a pair of compasses to construct a right-angled triangle with an area of 24 cm^2 .

The base of the triangle has been drawn for you.

You must show all your construction lines.

C ————— D

(3 marks)

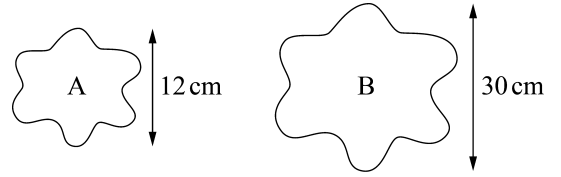
- 21** The point $A(1, 4)$ has been reflected in the line $y = x$ to give point B.

Show that the distance between A and B is $3\sqrt{2}$.

(4 marks)

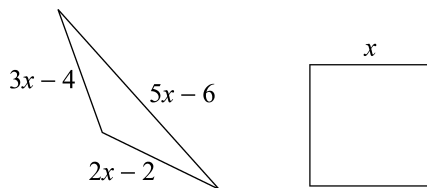


- 22 These shapes are mathematically similar.
 The area of shape A is 80 cm^2 .
 Calculate the area of shape B.




..... cm^2
(3 marks)

- 23 The perimeter of the triangle is the same as the perimeter of the square.
 The lengths are given in centimetres.



Calculate the area of the square.


..... cm^2
(5 marks)

- 
- 24 Find the integer value of x that satisfies both of these inequalities.

$$2x + 3 > 7$$

$$3x - 4 < 8$$

(3 marks)

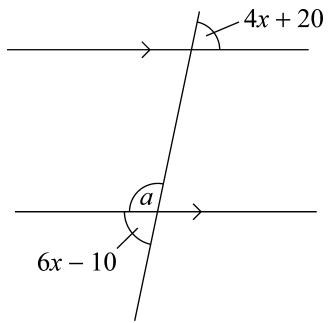
- 
- 25 Find the largest value of $y - x$, where x and y are integers and satisfy these inequalities.

$$3 < 2x + 7 < 15$$

$$3 < 3(y - 2) < 18$$

(3 marks)

- 26 The diagram shows three straight lines.



Calculate the numerical value of a .

(4 marks)


- 27 C is a curve with equation $y = x^2 + 2x - 15$

L is a line with equation $y = x + 5$

L intersects C at two points, S and T.

Calculate the exact length of ST.

(6 marks)



28 There are 40 people at a sports centre one weekend.

All 40 people play at least one sport from tennis, squash and hockey.

8 people play tennis, squash and hockey.

13 people play tennis and hockey.

14 people play tennis and squash.

10 people play squash and hockey.

25 people play hockey.

21 people play squash.

a Draw a Venn diagram to show this information.

(3 marks)

b One person is chosen at random.

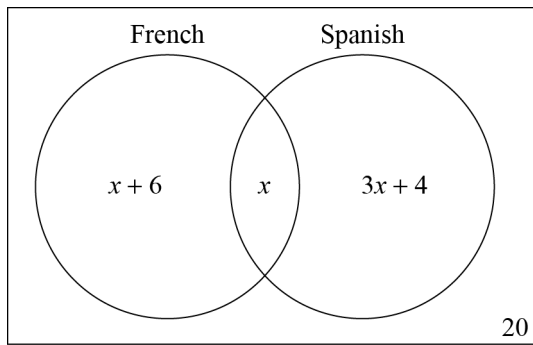
Find the probability that this person plays squash but not tennis.

(1 mark)

c Given that a person plays tennis, find the probability that they also play hockey.

(2 marks)

29 The Venn diagram shows the languages being studied by 50 students in a school.



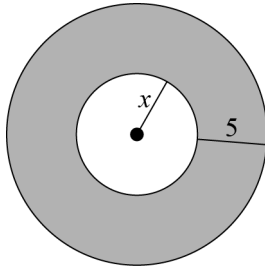
A student is chosen at random.

Given that the student studies Spanish, calculate the probability that they also study French.

(4 marks)

30 A coin is dropped onto this circle.

It can land on the shaded area or the unshaded area.



Write an expression for the probability that the coin lands on the shaded area.

(3 marks)

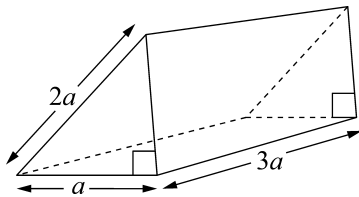


- 31** Pierre invests £8000 in a savings account for 3 years.
 He is paid 4.25% compound interest.
 Pierre has to pay 40% tax on the interest earned each year.
 The tax is taken from the account at the end of each year.
 How much is in Pierre's account at the end of 3 years?

(4 marks)

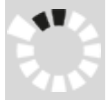


- 32** A piece of wood is carved into a triangular prism.
 The lengths are given in centimetres.

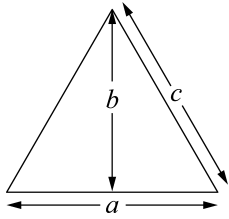


- The density of the wood is 0.5 g/cm^3 .
 Write an expression in terms of a , for the mass of the wood.

(3 marks)



33 The area of this triangle is 20cm^2 .



a Show that $a \propto \frac{1}{b}$

(2 marks)

b What is the constant of proportionality?

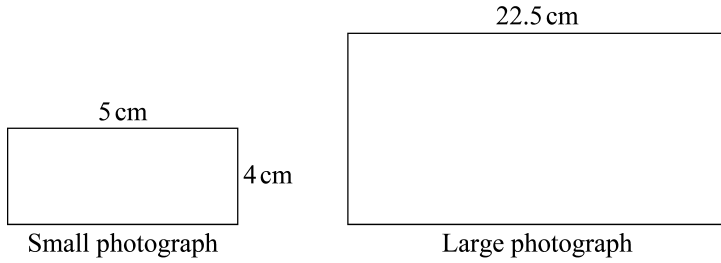
(1 mark)

c Calculate the length of c when the height of the triangle is 10cm.

(3 marks)



- 34 A small photograph has a width of 5 cm and a height of 4 cm.
 It is enlarged to make a larger photograph.
 The larger photograph has a width of 22.5 cm.



Not drawn accurately

The two photographs are similar rectangles.
 Calculate the area of the larger photograph.

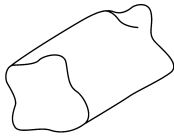
.....cm²

(3 marks)

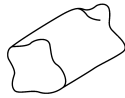


35 Prisms A and B are similar.

A has a volume of 750cm^3 and B has a volume of 162cm^3 .



Prism A



Prism B

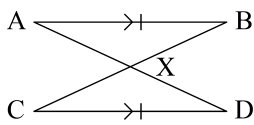
The surface area of prism A is 200cm^2 .

Show that the surface area of prism B is 72cm^2 .

(5 marks)



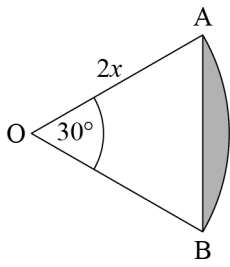
36 In the diagram $AB = CD$. Line AB is parallel to CD.



Prove that triangles AXB and CXD are congruent.

(3 marks)

37 In the diagram OAB is a sector of a circle with centre O.

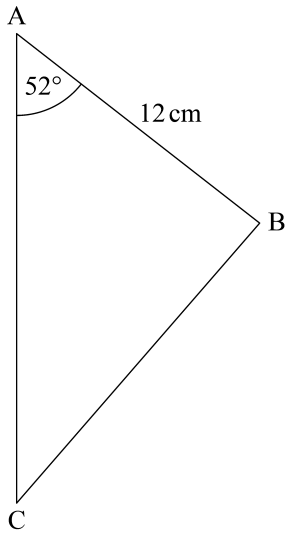


Show that the area of the shaded region can be given as $\left(\frac{\pi}{3} - 1\right)x^2$

(6 marks)



38 ABC is a triangle.



$AB = 12 \text{ cm}$.

The area of the triangle is 80 cm^2 .

Work out the length of BC.

Give your answer to 3 significant figures.

..... cm

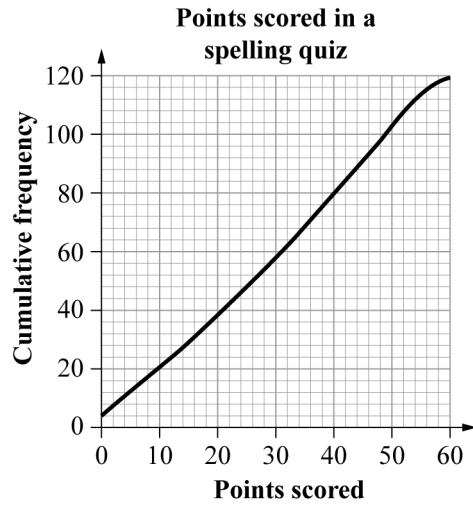
(6 marks)



39 The cumulative frequency graph shows how many points were scored by 120 people in a spelling quiz.

The maximum number of possible points was 60.

Any person who scored more than 87% of the points went through to the next round.



a Calculate an estimate of the percentage of people who went on to the next round.

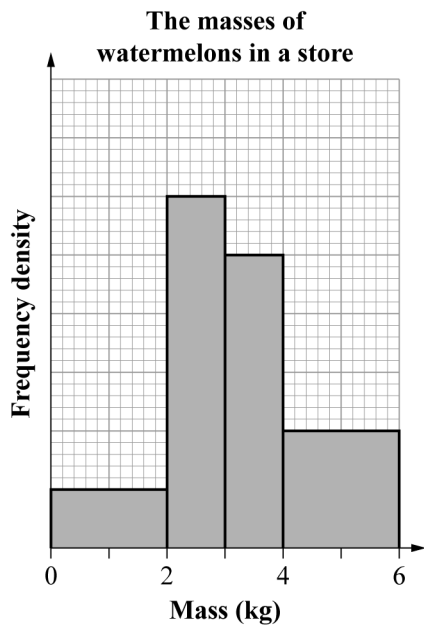
(5 marks)

b Explain one assumption you have made that could affect your answer to part **a**.

(1 mark)



40 The histogram shows the masses of watermelons in a store.



6 watermelons had a mass of between 0 and 2kg.

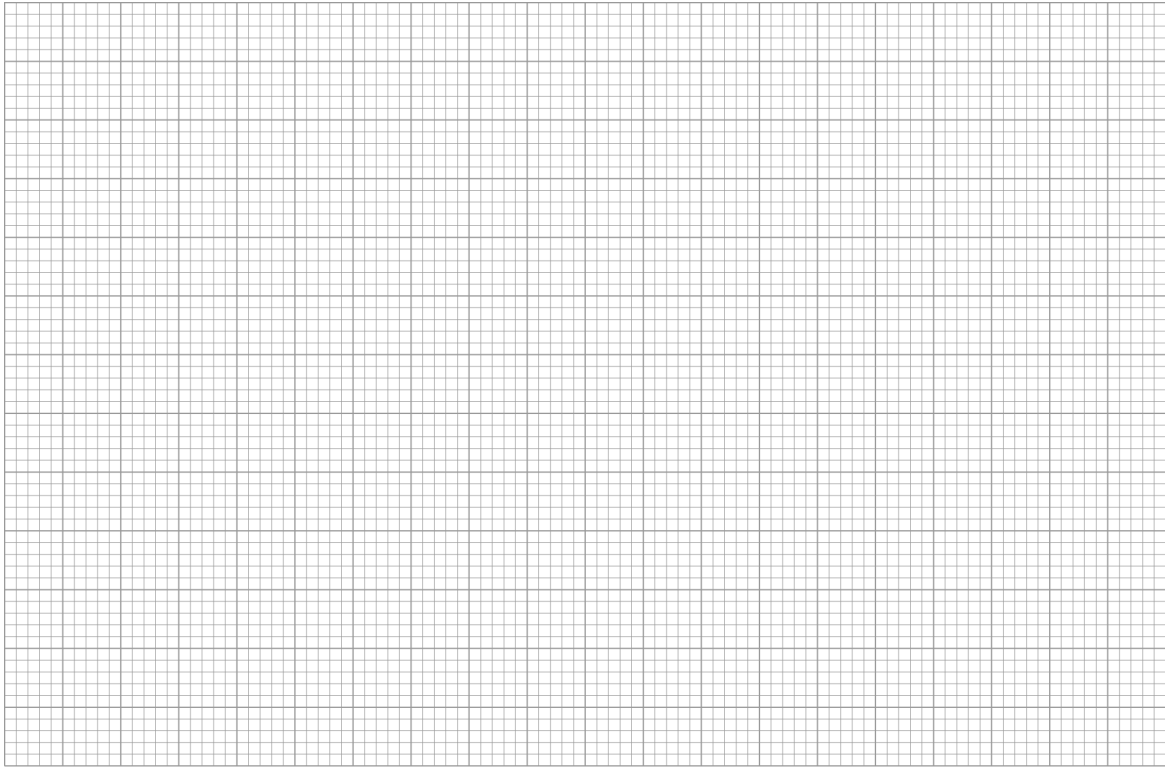
Calculate the percentage of watermelons that were larger than 4kg.

.....%

(4 marks)

41 For the graph of $y = x^2 + 2x - 8$

a What are the coordinates of the points where the graph crosses the x -axis?



(3 marks)

b Write the equation of the line of symmetry of the graph $y = x^2 + 2x - 8$

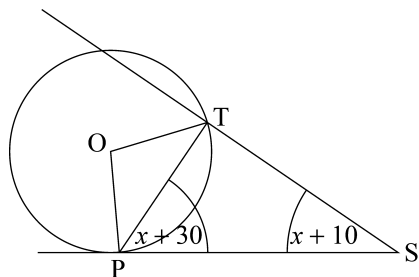
(1 mark)

42 P and T are points on the circumference of a circle, centre O.

PS is a tangent to the circle.

Angle PST = $(x + 10)^\circ$

Angle TPS = $(x + 30)^\circ$



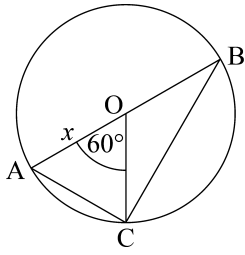
Write an expression for angle OTS in terms of x .

You must give reasons at each stage of your working.

(6 marks)



- 43 ABC are points on the circumference of a circle, centre O.

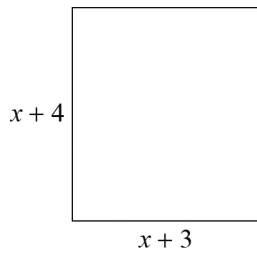


Angle AOC is 60° .

Show that the area of triangle ABC is twice the area of triangle AOC.

(7 marks)

44 The area of this rectangle is 30cm^2 .



a Show that $x^2 + 7x - 18 = 0$

(3 marks)

b Solve the equation $x^2 + 7x - 18 = 0$ to find the value of x .

$x = \dots\dots\dots$

(2 marks)

c Calculate the perimeter of the rectangle.

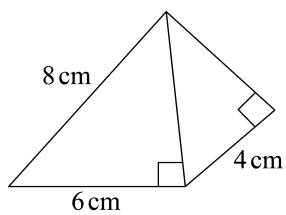
$\dots\dots\dots\text{cm}$

(2 marks)

- 45 The sum of the squares of two consecutive numbers is always odd.
Prove this is true algebraically.

(3 marks)

- 46 Find the area of this 2-dimensional shape. Write your answer in surd form.



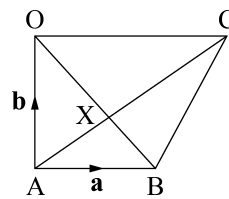
(5 marks)



- 47 A plane flies from the airport on a bearing of 060° .
It travels at a speed of 225 km/h .
Write the column vector for the velocity of the plane.

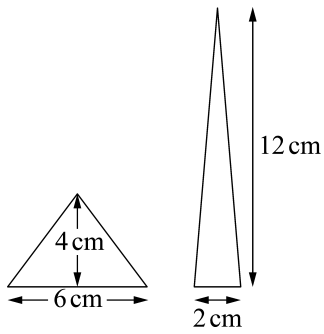
(3 marks)

- 48 OABC is a trapezium.
 $OC = 2AB$
 $OX : XB = 2 : 1$
Show that AX is $\frac{1}{3}AC$.



(5 marks)

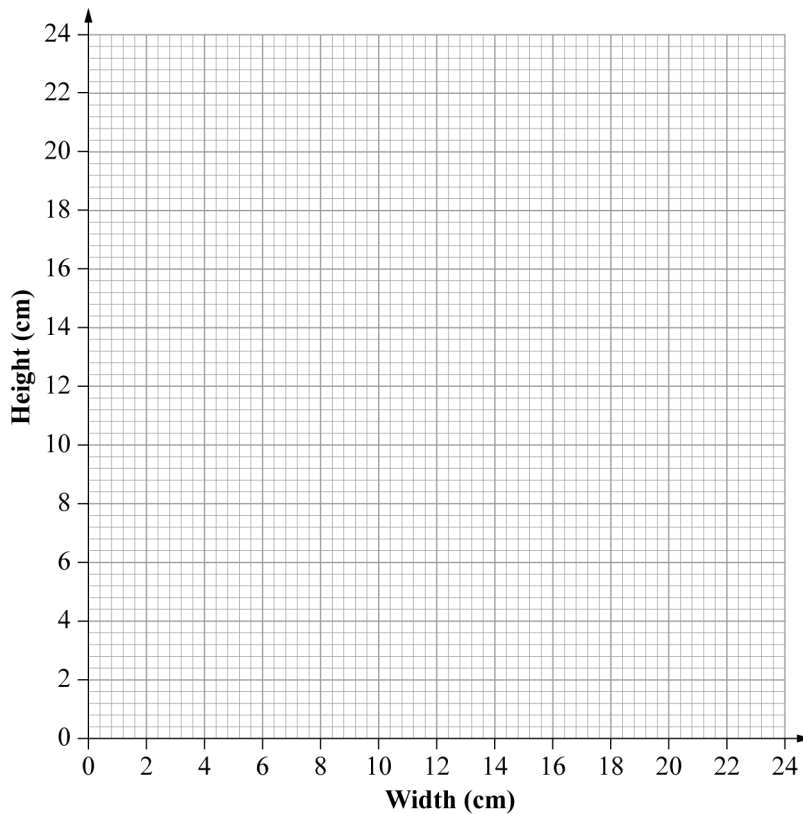
49 The area of a triangle is 12cm^2 .



a Describe the relationship between the width and height of a triangle with a fixed area of 12cm^2 .

(1 mark)

b Plot a graph to show the relationship between the width and the height of a triangle with a fixed area of 12cm^2 .

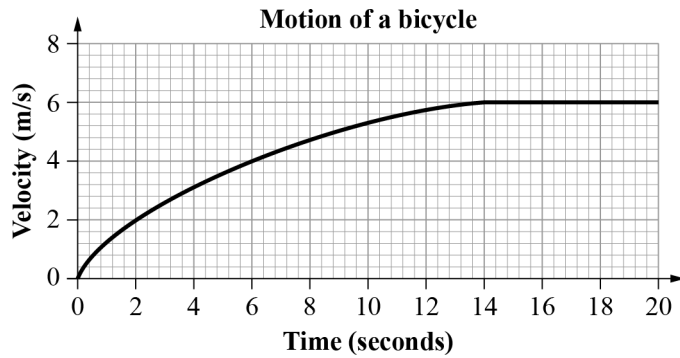


(4 marks)

50 The velocity-time graph describes the motion of a bicycle.

Velocity, v , is measured in metres per second (m/s) and time, t , is measured in seconds.

The bicycle travels along a straight road.



a Estimate the acceleration at 4 seconds.

(3 marks)

b Estimate the average speed of the cyclist for the journey.

(4 marks)

Overall mark	/224
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